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THE CASTOR OIL PLANT.

This plant has been known from extreme antiquity, specimens having been found in Egyptian tombs, supposed to be over 4,000 years old. It was known to the Greeks as *Aporave*, and to the Romans as *Ricinus*; the Hebrews called it *Kikayon*; it has been suggested that it was the plant translated in the scriptures as gourd. Oil expressed from its seeds was considered by the ancients, including the Hebrews, as one of their pleasantest oils for burning and for domestic uses, though its medical virtues were unknown to them.¹

In its native India this plant is a perennial, but as it has spread farther and farther into less congenial climes, it has, like the cotton plant, lost that habit and is known to the inhabitants of the United States as an annual.

There are numerous varieties, but most of them are derived from the *Ricinus communis*. In India and the United States, the two largest producers of castor beans, *Ricinus communis*, is, almost without exception, the variety used for oil production, although others are sometimes used as ornamental plants, yet *Ricinus sanguineus*, as will be seen from the following analyses taken from Semler,² is the best oil producer:

| | Seed of <i>R. sanguineus</i> . | Seed of <i>R. communis</i> . |
|----------------------------------|-----------------------------------|---------------------------------|
| Water | 4.40 | 4.10 |
| Fat | 46.95 | 45.55 |
| Starch | 8.87 | 12.50 |
| Nitrogenous substances | 3.78 | 2.40 |
| Non-nitrogenous substances | 6.35 | 4.40 |
| Fiber | 25.50 | 27.70 |
| Ash | 2.90 | 2.94 |

These analyses were of seed grown in the United States, and therefore the oil content is not so high as it would have been had the seed been grown in some tropical, or even semi-tropical country, where from 50 to 60 per cent may be expected.

¹ P. L. Simmons in Tropical Agriculture, p. 406.
² Semler, Tropische Agrikultur, Vol. II, p. 485.

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The common idea, that the castor bean plant can be cultivated wherever Indian corn will thrive, may be true as far as its use as an ornamental plant only is desired, but is not applicable when it is to be cultivated in commercial quantities.

There being no use to which other parts than the bean of the plant can be successfully put, and the value of this being dependent upon its oil content, the general truth applicable to nearly all oil bearing plants, viz., "the warmer the climate the larger the per cent of oil," greatly diminishes the value of this crop grown in the northern half of the corn belt.

Because thrifty farming requires the planting of only such crops as will reach their highest development and yield a satisfactory pecuniary return, the castor bean can not be successfully cultivated in the northern part of the United States, although Indian corn thrives there, and some varieties of the castor bean will mature seed. Even in sections where the warmth and period of growth are sufficient for the successful growth and development of oil by the castor bean, a very deep and fertile soil is required, well supplied with nitrogen, phosphoric acid, and potash, and, if it is not virgin soil, the use of manure or commercial fertilizer can not be omitted.

The soil must also be neither too light nor too heavy, too close nor too porous—stiff clay is unfitted for the culture of the castor bean, also light sand. Like Indian corn, it demands a sandy loam or a clay loam for the best results. In every case the soil must be friable, deep, and well drained.

The castor bean may follow any clean crop, or it can be cultivated successfully for several years in the same field, provided a sufficient manuring is given. A mixture which contains all the needed elements of plant food can be made as follows:

500 lbs. cotton seed meal.

1,000 lbs. stable manure.

500 lbs. superphosphate.

This should be kept in heaps under a roof, and should be sufficiently moist to prevent firing. Of this mixture from 1,000 to 3,000 pounds should be used per acre, according to the fertility of the soil and the amount of manure used the preceding year.

Planting should be in hills five or six feet apart each way, and the seed, after being soaked twelve hours in luke-warm water, should be placed two in each hill, and carefully covered with one-half inch of soil.

When three or four inches high the weaker plant should be removed, leaving one to each hill—leaving two plants to the hill is a very bad practice followed by some growers; it is better to reduce the distance between hills even down to $4 \times 2\frac{1}{2}$ feet, if there are not enough plants to the acre, than to crowd them by leaving two in the hill.

The ordinary surface stirring and weed destroying is essential. The plow has no place in castor bean cultivation after planting, as it cuts too deep or throws too much soil to the plants, which will not bear being hilled up. The horse cultivator, with hand hoes for working close to the plants, gives the best results.

The seed spikes are collected as soon as the pods assume a brownish color, and before the seeds are so far matured as to drop out of the pods in handling. When gathered, they are exposed to the sun

until the seeds part freely from the pods. Frequent gatherings are necessary in order to remove such spikes only as are in proper condition. The profits of this culture are said to be somewhat greater than of corn, from 20 to 25 bushels per acre being an average yield.

According to information supplied by Mr. William Saunders, Horticulturist and Superintendent of Gardens and Grounds, the following is the ordinary process of extracting the oil from the bean. The seeds are first cleaned from dust and all extraneous matter, then placed in an iron vessel and submitted to a gentle heat, which facilitates the extraction of the oil. They are then placed under the action of a screw press, which liberates a whitish oily liquid, which is then mixed with water and boiled for some time, the impurities being skimmed off as they rise to the surface. A clear oil is at length left upon the top of the water, the mucilage and starch being dissolved, the albumen coagulated by the heat, forming a whitish layer between the oil and the water. The oil is further clarified by boiling it along with a little water, the heating being continued till aqueous vapor ceases to rise. This drives off the acrid volatile matter; but if heated beyond what is necessary to the removal of the water, the oil acquires a peppery taste and a brownish color.

It is said that the superiority of the best Italian castor oil, which is characterized by the absence, in a great measure, of the usual nauseous flavor of ordinary castor oil, is owing to its being prepared in summer from seeds collected during the previous year. The outer skin, which has become somewhat hard, is cracked by slight blows of a hammer, and when this shell is removed, the interior is submitted to gentle and continuous pressure. The exuding oil is filtered with as little exposure to air and light as possible. This makes an expensive oil.

Another method of procuring castor oil comparatively free from unpleasant taste or smell, also practiced in Europe, is to boil the seeds in water for two hours, when they are taken out and dried by exposure to the sun for several days. The skin or shell is then removed and the seeds pounded, then boiled in fresh water until the whole of the oil has risen to the surface. Three and a quarter pounds of seed will, by this process, yield one quart of oil of a fine straw color, but it is of inferior quality. In this country medicinal castor oil is usually manufactured by cold expression from the crushed beans. In order to rid the oil of a disagreeable acrid principle that the beans contain, they are usually heated for some time until they are browned but not burnt. Then the hulls are broken or crushed by running the beans through a mill for the purpose, and the pulpy mass is inclosed in bagging and subjected to hydraulic pressure. After this cold drawn oil has been expressed, a second, inferior quality is obtained by treating the beans with hot water, and again pressing them. The oil is then heated for some time not quite to the boiling point, and the coagulated albumen and mucilage which rises to the top is carefully skimmed off. The oil is next strained and is ready for market. Castor oil for machinery, wagons, etc., may be expressed from raw beans treated with boiling water.

When castor oil is heated in a retort, about one-third of it will distil over and a substance resembling India rubber will remain, which saponifies with alkalies.

This oil is largely used in soap manufacture and makes a clear light colored soap which dries and hardens well.

Castor oil is the thickest and heaviest of the oils, its specific gravity being 0.969 at 53 degrees F. At a temperature of 4 degrees F. (—18 degrees C.) it becomes a transparent, yellow, solid mass. By exposure to the air it becomes rancid, thick, and at last dries up, forming a transparent varnish. It dissolves readily in its own volume of pure alcohol and is bleached by exposure to sunlight.